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CONTENTS

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Lessons of the Grand Prize of Paris

ALTHOUGH the French air transport competition for the Grand Prize of Paris failed to reveal any revolutionary departure in the design of commercial airplanes, it should afford much food for thought to those concerned with the fostering of air transport.

To begin with, it should by now be obvious that a competition between aircraft embodying new and untried ideas should be held at a time of the year when reasonably good flying weather may be expected. It is true that commercial aircraft will have to fly in almost any kind of weather, yet there are too many important things at stake in a public competition to want to complicate matters by introducing what may be called atmospheric obstacles.

Another point well worth notice in the Paris competition was the provisions made with a view to improve the passenger accommodations, specifying seat dimensions, leg room, etc. But we should like to see a minimum limit placed on the disposable volume of air per passenger, for this factor has an important bearing on comfort, and so does the problem of draftless ventilation, the solution of which should be especially encouraged.

Perhaps the most significant feature of this competition was the remarkably good showing made by Bréguet Leviathan. This ship embodies the central engine arrangement with which the Germans experimented during the war without, however, reaching a satisfactory solution. For over two years the power plant of the Leviathan underwent exhaustive tests, and to many observers it seemed as if the proposition of connecting four engines to a single propeller shaft were a hopeless one. Now this ship has successfully passed such severe tests as disconnecting one power unit in flight and climbing in this manner, of again starting the engine in flight, and last but not least of keeping the whole power plant of 900 horsepower running in flight for several hours. This is a performance which augurs well for the practical realization of the central engine room on aircraft, even though much remains to be done to make the system practical.

Perennial "Inventions"

DUE probably to the growing familiarity of the airplane, it seems to invite fewer impractical inventions of the recurring type than formerly. The lighter-than-air field however is still a hotbed for the purely qualitative inventor. It is remarkable also how many investors size up a new idea simply in terms of "plausibility," without referring it to anyone who can make a detailed and impartial study of the subject in comparison with other known methods.

It is not desired here to discourage new or even radical ideas in aircraft design. But it is only fair to put people on their guard against a certain class of ideas which are neither new nor practical, "inventions" which have appeared dozens of times in various forms, but which have always gone on the rocks when put to the test of quantitative analysis or practical trial.

The following devices for airships, while conceivable, are nevertheless of proven inefficiency compared with other known means, and are based mainly on misconceptions of the conditions involved.

1. Blower propulsion.
2. Compressed air or gas as substitute for ballast.
3. Inflation with hot air.
4. Means for vertical control on an even keel.
5. "Fancy" hull shapes with no approach to a circular cross section.
6. "Vacuum airship" (absolutely unworkable with present materials).

The following are usually designed to relieve conditions which are nonexistent or inconsequential:

7. Pipes to relieve "suction" behind the hull.
8. Various elaborate schemes to eliminate ballast.
9. Means of increasing the "lift" of the gas.
10. Mechanical substitutes for the screw propeller.
11. Placing the line of thrust at the center of resistance.
12. Means for relieving the force of a "side wind" when in flight.

The following bring in difficulties, hitherto out of all proportion to the advantage gained:

13. Combined airship and airplane.
14. Double or "catamaran" airships.

Inventors and investors alike would do well to keep this list on their desk for handy reference before letting their imagination get out of bounds over "inventions" which are "bound to revolutionize the art of aerial navigation."

Using Obsolete Aircraft

THE occasional reports which the daily press publishes on the progress of the New York to Brazil flight indicate a series of mishaps which have greatly delayed the trip. This is highly regrettable, for these delays have a much greater significance than merely a slow voyage.

The use of obsolete types of aircraft for long flights into unknown regions or into countries where aeronautical resources are few and far between is obviously unfortunate. The first requirement which such pioneer aircraft should fulfill is ruggedness, for the abnormal conditions under which they are called to operate demand every inch of it. Another essential requirement for insuring the success of such an expedition is the carrying of sufficient spare parts for making minor repairs en route, unless they can be stored at convenient points of call. Failure to carry a spare propeller along delayed the Sampaio Correa five weeks.

Unless these two fundamental requirements are given the thought they deserve, such trips cannot be successful and American aircraft will suffer from unfavorable comment in the very places where it is intended to boost them.

The Martin Observation Airplane

Metal Cantilever Monoplane Equipped with 375 hp. Curtiss D12 Engine Built as Gun Spotter for Navy

A new type of "gun-spotter" for directing the fire of battleships from the air which was designed under Navy specifications by the Glenn L. Martin Co at Cleveland, Ohio, has recently been undergoing a series of tests by a trial board According to opinions of experts in the Bureau of Aeronautics, Navy Department, the new ship gives every promise of success.

The new plane, known as the Martin Observation or MO1, is a three-seater monoplane with an all metal frame construction of aluminum alloy, and is designed for spotting and for short distance reconnaissance work. It is equipped with a 375 hp Curtiss D12 engine.

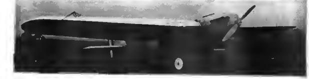
Airplane spotting as a practical method of fire control has been thoroughly worked out in target practices held by the battleships during the past two years, but the planes used for the purpose were adaptations of existing types and were not altogether suited to the service requirements. The Martin Observation has been specially designed to become an integral part of the fire control organization of the modern battleship and as such will have an important bearing on the accuracy of naval gunnery

The development of a spotting plane is another step in the way of providing aircraft specially equipped and specially suited to naval requirements. Prior to the war little more was expected or required of planes than that they fly During the war the tendency was toward the development of bombing and scouting planes to combat the submarine menace, but since the Armistice the needs of the Navy in aviation have been the subject of careful study which has resulted in a specialized development of types. This was reflected in the F5L scouting planes, the recently developed Douglas torpedo planes, the TS combat planes, and now the MO1 three-seater spotter

To suit the varied conditions under which a naval plane must operate, the MO is designed for interchangeable landing gear which will make it adaptable for landing and taking off from the deck of an airplane carrier, or in place of wheels for landing and taking off pontoons may be substituted which will permit of landing and taking off from the water The plane is also designed to be quickly assembled and knocked down for stowage in a small space, a feature that will make it particularly suited to conditions on shipboard The all metal feature of construction insures greater life and durability, and is at the same time a measure of economy in the repair and upkeep of the aircraft squadrons of the Navy This with its attending advantages is a direct result of investigation and research conducted by the Bureau of Aeronautics

Spotting of gunfire from the air marks a new epoch in naval gunnery Heretofore and from time immemorial the fall of shots on an enemy target were observed from the mast head of the ships and the accuracy of fire was communicated to the gunners by the observers. With the adaptation of aircraft to spotting the observer now hovers over the line of fire and the panorama of the naval battle is spread out below him Estimates of distances can be made with the greatest accuracy The information thus obtained is quickly and accurately communicated to the firing ships by radio installation in the plane

The design and specifications of the new Martin Observation plane were prepared by the Design Division of the Bureau of Aeronautics, Navy Department, under the direction of Commander J C Hunsaker, U S N Its actual performance, before the Navy Trial Board, as to high speed, low speed, climb, ceiling, load and maneuverability, exceeded in every case the specified requirements This is considered very gratifying in view of the really new features in its design and construction, chief of which was the unique design, using heat-treated duralumin in the wing and empennage units Still more gratifying was the fact that the complete airplane is *under* the guaranteed weight and *over* all the specified factors of safety



Three-quarter front view of the Glenn Martin "Observation" plane—a gun spotter developed for the U S Navy See also illustration on front cover page

The Type MO1 was designed primarily for the purpose of directing gun fire of battleships. The main requisite for spotting is complete visibility below, and for this reason the monoplane type was selected with the wing above the fuselage There are no blind spots

Wings

The wing curve used is a modified USA27 The wing itself is built in three sections, and so far as known is the lightest metal type of its capacity developed and built in this country Under sand load before Navy experts it developed a safety factor of 8 The center section chord is uniform, but the two outer sections taper from a 11 ft 6 in chord at the root to a 6 ft 6 in chord at the tips. The wing beams are of built up Pratt-truss construction, the main longitudinal members being of ⅛ in and 3/16 in duralumin formed in "horseshoe" shape with a steel stiffener placed in the open part of the "horseshoe" The diagonal members of the beam are of 16 and 18 ga. duralumin tubing, all attachments being accomplished by means of heat treated duralumin rivets and fish plates The same material is used in the drag trussing.

Attachment of the outer wing sections to the main or center section is made by the use of steel ball and-socket hinges. Wing ribs are of spruce, with ash nose strips and balsa wood

fillers in the compression members. Covering is of grade A cotton, fireproofed, doped, enamelled and varnished

In the center section, on either side of the fuselage, are located the two gasoline tanks. These are of spun aluminum, conical in shape and provided with a novel arrangement of baffle plates. Their capacity is 57 gal. each The tanks are so mounted in the wing structure that in case of fire, they may be released by either the pilot or observer in such a manner that they are thrown clear of the floats and tail surfaces. In such an event, the only gasoline remaining would be that in the carburetor and a short length of pipe.

The two ailerons are built up of channel section duralumin and are controlled by cables running over pulleys inside the wing structure They are of the submerged balance type

Fuselage

The fuselage structure is rectangular and is built up entirely of steel tubing, the joints and strut attachments being made by riveting and welding At several points, effective use was made of a new method known as rosette welding The usual tie rods are used in the internal bracing. The Curtiss D12 375 hp engine is mounted on ash bearers attached to the steel forward structure and may be readily removed as a unit with the bearers attached. The motor is completely cowled in with aluminum At the side of the motor and above the carburetor, a pressure fire extinguisher is provided with a control from the pilot's and observer's cockpits. In case of fire at the motor, the pyrene mixture may be released in an effective spray over all parts of the motor Set in the cowling streamline below the motor is a welded aluminum oil tank equipped with fins for the effective cooling of the oil. An aluminum fire wall separates the motor from the pilot's cockpit, which is directly back of and above the motor at the leading edge of the wing This position allows exceptional visibility for the pilot as well as plenty of room and accessibility to controls. Immediately in the rear of the pilot and below the wing is the observer's cockpit, the position of which permits unobstructed vision to either side and below An auxiliary set of controls and instruments provides facilities for piloting from this cockpit. Access to the observer's cockpit, as well as to the pilot's and rear gunner's positions, is by means of a swinging door at the side At the rear of the observer's cockpit, and connected by a runway, is the rear gunner's position at the trailing edge of the wing By means of the flexible gun here in combination with the other gun equipment, the plane is protected from all directions

Tail Surfaces

The tail surfaces are of the internally braced type There are two elevators, (operated as one unit) one stabilizer, one rudder and one fin. The elevators and rudder are entirely of channel, lyre and horseshoe section duralumin, while the stabilizer and fin structures are of duralumin with ribs of spruce The stabilizer is adjustable and may be trimmed while in flight The rudder is of the wind vane balanced type The rudder and elevator controls are of the external type, while the stabilizer control cables run inside the fuselage.

Landing Gear

Both land and water gear are provided For land purposes, the conventional two-wheel, wide-gage type is furnished The struts, braces and axles are of tubular steel with welded and riveted fittings and streamlined with sheet duralumin. The wheels are equipped with 36 in x 8 in. tires

The land type gear may be removed at the fuselage attachment fittings and a gear comprising two seaplane floats with struts and braces, attached in place The entire structural weight of the plane complete with equipment and land type gear is 2920 lb , while its weight equipped with floats is 3305 lb

After thorough testing in the air for many hours, the plane is found to be free from any erratic features in the way of performance or at the controls, and proving itself to be a real flying machine in every respect Another interesting feature is the fact that the horsepower required to fly level is quite low, so that the cruising radius at reduced speeds is exceptionally long

Log of the Duration Record Fokker T2

Following is the log of the Army Fokker T2 monoplane on which Lieuts. John A Macready and Oakley G Kelly made an unofficial world's duration record last October at Rockwell Field, San Diego, Calif

Took off at 5 53 a m Thursday, Oct. 5, 1922

Landed 5.11.30 p m. Friday, Oct. 6, 1922

Elapsed time—35 hr 18 min. 30 sec.

Total weight at take-off—10,695 lb Total gasoline 697 gal. (4,231 lb.)

Total oil Penzoil Triple Extra Heavy—35½ gal

One Liberty engine—400 hp

Two pilots.

Gasoline drained after flight—10 gal

Oil drained after flight—18½ gal.

Gas consumed—687 gal Average gasoline consumption per flying hour—19 5 gal ; oil consumed, 17 gal Average oil consumed per flying hour—0 48 gal.

The r p.m. averaged from 1520 full out to 1160 At the end of the first period (6 hr.) average r p m. 1440. Second period average r p m.—1420 Third period average r p.m.—1350, Fourth, 1340; Fifth, 1260, Sixth, 1180

Due to a rough place in the carburetors it was impossible to slow down the r p m. in the fourth period. After 18 hr approximately 60 revolutions were lost by cutting either switch After 21½ hr. the generator was cut out for an instant and 50 revolutions were lost while running on the battery at 1350 r p m

Previous to the flight considerable time was spent picking a smooth set of distributor heads The distributor cam was vasolined and the felt used in this cam soaked in oil. Hard distributor carbons were used with the spring tension reduced to a minimum A light coating of vasoline was placed on the distributor track. The breaker points were set at 0 015 with a 0 013 spark gap and the safety breaker removed

The oil pressure remained constant at 45 lb. during the entire flight.

The engine temperature could be well controlled and was held at approximately 75 deg to improve carburetion

No constant altitude was maintained, the altitude varying from 800 to 4500 ft

Only three quarts of water were required to fill the radiator on landing The loss was due entirely to expansion.

The following repairs were necessary after the flight:

(a) Slight leak in core of booster radiator, also a slight leak due to the cowling rubbing on the booster radiator

(b) The left exhaust manifold was cracked on the elbow and three lugs were cracked on the left long exhaust stack.

(c) The right upper side cowling was cracked.

(d) Both outside tire streamlines ripped from the retaining ring around the hub

(e) The distributor heads were in excellent condition The right head showed no wear while the left head had 0 013 clearance against the original 0.015 setting

(f) All spark plugs were in excellent condition.

(g) The left forward celluloid window cracked and became loose and the screws loosened in the other windows.*

Possibilities in Mexico

William G Shauffler, Jr returned recently from a business trip in Mexico where he reports unusual opportunities existing for the development of air transport. He has an interesting proposition where two types of planes may be required; (1) two passenger small machines, capable of a quick getaway with full load at 7,800 ft. above sea level; (2) cargo planes carrying reasonable pay loads.

Interested persons are advised to communicate with him, care L. V. D., 349 Madison Ave., New York City

* The Engineering Division, Air Service, McCook Field calls our attention to an error which occurred in the story relating to the duration flight of this ship, printed in the Nov 13, 1922 issue of AVIATION Contrary to what was said the radiators did not leak on the Fokker T2 during this flight or at any time In fact they continued to function until more than four-fifths of the normal water supply was lost The leaks which did cause the trouble were in the cylinder water jackets.—EDITOR.

Interpretation of Meteorological Maps

Free Air Conditions May be Deduced from Proper Interpretation of Surface Conditions

By C. LeRoy Meisinger

Meteorologist, U. S Weather Bureau

Most of the questions put by the aviator to the aeronautical meteorologist concern the state of the free air. The pilot is interested, usually, in the winds at flying levels, and he is particularly concerned in times of cloudy, or stormy, weather.

The meteorologist must base his answer either upon current aerological obervations or upon experience Current observations of free-air conditions are, of necessity, limited, both

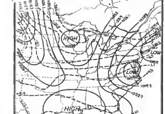


Fig 1—Distribution of sea-level pressure and surface temperature over central and eastern United States, 8 a m, (75th meridian time), Dec 17, 1919 (Pressures in millibars, temperatures in degrees, Centigrade)

by the cost of installation and maintenance of aerological equipment, and by the paradoxical circumstance that in unfavorable flying weather, it is impossible to observe pilot balloons to very great heights It is true that kites can penetrate the clouds, but the time required for the reduction of meteorograph observations, together with the paucity of stations, detracts somewhat from their current usefulness. Observations by means of kites and pilot ballons are absolutely essential to the proper conduct of free-air forecasting and research, but where the net-work of these stations is not sufficiently close, and in cases in which bad weather prevents a part or all of them from making observations, the meteorologist must resort to that alternative resource, his experience, in order to form an opinion concerning the behavior of the meteorological elements in the free air

The accuracy of this opinion will depend upon how closely be has classified and studied his experience. An opinion having a purely statistical basis must always be put forward with reservations and must always be applied with proper consideration of its limitations. For example, the newspapers, a year or more ago, were carrying accounts of the possibility of eight-hour flights from coast-to-coast. These glowing possibilities were based upon the reported statement of a well known aviator that winds at an altitude of about 30,000 ft of from 200 to 300 m p h "blow constantly from west to east" No doubt, high winds were experienced by the aviator at the aviator at that particular time of his ascent; but it is ridiculous to assert, or imply that such wind velocities are always to be found there. Similarly, yearly, seasonal, and monthly averages must be used with discrimination, for one cannot expect to find these average conditions occurring at any given time

The desirable type of statistical judgement is that which is sufficiently flexible to permit of its being applied to current conditions. To do this, it is necessary to relate free-air and surface phenomena, so that, by the simple observation of surface conditions, one may form a reliable estimate of what is to be encountered aloft This paper attempts to indicate how atmospheric pressure phenomena at free-air levels are related to surface wind direction, temperature, and pressure, and how, from these essential surface elements, something may be learned of the free-air wind direction and speed, even when the sky is covered with clouds.

Theoretical Considerations

Before discussing the data and the results to which they led, it is of interest to consider briefly the tools which meteorological physics has provided for the study The relations between atmospheric pressure, temperature, and wind

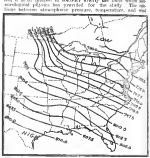


Fig 2—Distribution of barometric pressure at 2 kilometers above sea-level over central and eastern United States, 8 a m, (75th meridian time), Dec 17, 1919 (Pressures in millibars).

fall into two classes, the vertical and the horizontal.

We, who move about on the earth's surface, the floor of the atmosphere, are subject to the pressure of this superincumbent mass of air As one ascends in an airplane or balloon, the total amount of air above becomes less, hence the atmospheric pressure is also less. The altimeter, that essential of the instrument board, is an aneroid barometer which,

strictly speaking, measures not altitude, but atmospheric pressure. This decrease of atmospheric pressure with increase of altitude together with the underlying physical law, illustrate what is meant by the vertical relation.

Meaning of Horizontal Relation

On the other hand, suppose that two free balloons, equipped with similar altimeters ascend vertically and simultaneously from two points separated by a few miles. Suppose, further, that they ascend at the same rate, and not only that the vertical decrease of pressure is the same at both places, but that the actual pressure and altitude above sea-level are the same at the start. If all these ideal conditions are fulfilled, it is clear that, at any given instant, both balloons would be at the same altitude, not only as shown by their altimeters, but also as measured from some common level such as that of the sea. But if there were any difference in the rate of vertical decrease of atmospheric pressure between the two places, it is conceivable that the two balloons might actually be at the same height above sea-level but with altimeters reading quite at variance, or, the altimeters might show the craft to be at identical heights, whereas a measurement upward from sea-level might show them to be at considerably different altitudes. As a matter of fact, it is rarely that both the vertical rate of pressure decrease and the actual pressure are the same at any two points a considerable distance apart It follows, then, that if we establish arbitrarily some free-air level, parallel to that of the sea, two barometers, respectively above the points in question, would, under most conditions, yield differing readings This horizontal difference in atmospheric pressure, which as we shall see in a moment, is the cause of wind, illustrates what is meant by the horizontal relation.

Since gases contract with decrease of temperature, it is easy to see that a given mass of air may be contained within a thinner stratum over a cold station than over a warm station In other words assuming the total weight of air over two stations to be equal, we will find after we have ascended a certain distance above each that the pressure is lower over the cold station than over the warm An isobaric surface, or surface of equal pressure in the free air, will slope from the warmer toward the colder station Thus, the rate of fall of atmospheric pressure with increase of altitude is greatly influenced by the temperature of the air within the stratum under consideration The law of their vertical decrease of pressure was stated long ago by Laplace and is commonly known as the hypsometric formula.

Factors Governing Air Currents

As soon as a pressure slope is formed, the air above the warmer station will flow toward lower levels under the action of gravity When air begins to move under the stimulus of such a force, it is regarded as the blowing of the wind, and, if no other effects were operative, the wind would blow directly from above the warm station to the region above the cold. The meteorologist's world is not so simple as this for many influences come into play as soon as air attempts to move from one place to another At levels near the earth's surface, the wind will be retarded and deflected by friction and eddy motion Higher in the atmosphere, however, these retarding influences are not so powerful, and it is clear that the stronger the temperature contrast between the two places, the steeper will be the pressure slope and the relatively less powerful will be these disturbing factors.

But at all levels there operates another force, the effect of which can be accurately calculated It is the well-known deflective force of the earth's rotation which causes bodies moving over the earth's surface to be deflected to the right in the northern hemisphere and to the left in the southern Just as soon, therefore, as an air particle begins to move from a warm station to a cold, this force becomes operative, and in a short time, the particle is moving at right angles to the direction in which it started

Thus, if a warm station is south of a cold one, the air moves from west to east, if the warm station is east of the cold one, the air moves from south to north. In other words, the wind blows in a direction parallel, and not perpendicular, to the isobars. It is possible to compute the velocity of the wind corresponding to given conditions of air density, pressure gradient, and latitude. It is thus obvious that once we have accurate maps of the pressure distribution in the free-air, accurate conclusions regarding the winds at those levels may be drawn.

Available Aerological Data

The United States Weather Bureau has maintained for a number of years several kite stations for the collection of data on free-air temperature, pressure, humidity, and winds. Six of these stations are now operating and two have been maintained for a certain time and closed. These stations have accumulated records ranging in period from one to six years. With the exception of one of the six stations now operating, these aerological stations have been drawn upon for the basic material for the preparation of free-air maps.

We know that the surface air temperature in the central and eastern United States is strongly influenced by wind direction, and it seems reasonable that the vertical gradient of temperature—at least within the lowest several kilometers of the atmosphere—is similarly influenced. Moreover, the surface wind direction, where topographic or other obstructions do not interfere, is a consequence of, and, therefore, an index to, the distribution of atmospheric pressure. Hence, it appears that if we classify the difference between mean temperature of the air column and the surface temperature by surface wind directions, we thus obtain that flexibility of statistical treatment which will permit us to use current data. The quantity thus derived from the records of the several kite stations varies with surface wind direction and the different months. It is a small temperature value which may be added to, or subtracted from, the current surface temperature in order to obtain the mean temperature of the air column Having the mean temperature of the air column, the reduction to the selected free-air level is quickly accomplished by means of tables

The reduction levels selected were 1 and 2 kilometers above sea-level These were chosen because a large amount of flying is done below 2 kilometers, and because they are close enough to the earth's surface to be intimately related to the pressure distribution controlling the surface weather.

Having the required data from each of the aerological stations, tables were constructed for about thirty selected Weather Bureau stations. They apply to the regular observation made at 8 a m, 75th meridian time The maps extend westward only to the 100th meridian at present

The full significance of the applicability of these data can best be appreciated by an outline of the progress of making an actual reduction.

Among other data, the regular weather observer notes surface pressure, surface temperature, and surface wind direction He looks up in his table the difference between the mean temperature of the air column and the surface temperature corresponding to the observed surface wind and current month. He adds this value algebraically to the observed surface temperature. The sum is the probable mean temperature of the air above his station up to the chosen reduction level. Using this temperature as one entry and his observed station pressure as the other, he can look in a specially prepared table and read directly the pressure at the free-air level above his station The same process is carried out by other observers at other stations, with the result that when the pressure values are collected upon a map, such as the daily weather map, lines of equal pressure can be drawn upon them, just as the sea-level isobars are drawn at present The forecaster can then interpret these data. The making of the maps represents the application of the vertical relations mentioned at the beginning, the interpretation represents the application of the horizontal relations.

Accuracy of the Free-Air Charts

The accuracy of these maps hinges upon the accuracy of the mean temperature of the air column. Hence, it is not only interesting, but absolutely essential, to obtain some estimate of the accuracy of the method. This can be done in several ways

First, statistical method supplies means of judging the accuracy of an average value of any quantity based upon the magnitude of the departures of the individual quantities from

that mean. When such a test was applied to these data, it was found that large errors would occur very rarely indeed.

The second, and more interesting test consisted in comparing pressure computed by this method with those actually observed by kites. An opportunity to do this was furnished by the kite station at Due West, S. C., a station whose data were not used in the study owing to its short record. In about 42 such tests the average error for reductions to the 1-kilometer level were about 0.5 mb. (0.015 in.) and for the 2-kilometer level about 1.0 mb. (0.03 in.). The largest single error noted was about 5 mb. (0.15 in.). Errors of this magnitude are not serious when they are not localized. If they occur at adjoining stations also, the barometric gradient is but little affected, and it is the gradient rather than the absolute value of the pressure that is of greatest significance. Thus, the second test yielded quite satisfactory results.

In the third place, the very relations between wind and horizontal pressure gradients have been used to test the reductions, for, once having the map of pressure at a given level, we may compare the gradients there shown with the actual wind observed with kites or pilot-balloons. This was done for a number of dates selected at random and distributed throughout the year. In the vast majority of cases, the observed winds agreed very satisfactorily with the trend of the isobars.

Pressure Variations at Different Levels

The distribution of pressure in the free air is often, but not always, quite different from that at sea-level. From the theoretical considerations mentioned earlier, it is seen that the greatest difference will occur in the winter, when the latitudinal gradient of surface temperature is steepest. At such times, there may be a rapid change in the distribution of pressure as one ascends from sea-level, and this sometimes produces a rapid turning of winds from the surface direction to west or northwest. In the summer, when the latitudinal temperature contrast is slight, the pressure formations retain their identity to great heights. Sometimes cirrus clouds are seen to move from the east. This type of cloud is the highest, and the fact that winds as high as 10 km. above the earth have a motion from the east implies that the mean temperature of the air between the surface and that high level is actually higher in the north than in the south—a phenomenon which could occur only in summer in the United States.

One striking case may be cited and illustrated. It is emphasized that this example is extraordinary, and is not to be regarded in any sense as representing the usual variations between the sea level map and the maps for the upper levels. It shows, nevertheless, what may occur and what has occurred, and the significance for aviation at such times would be great.

Highest Recorded Wind Velocity

On Dec. 17, 1910, the Weather Bureau pilot-balloon observation at Lansing, Mich., yielded the highest wind velocity ever recorded in the United States below 10 kilometers (6.2 miles). This velocity was 83 meters per second, (186 m.p.h.) and it was observed at an altitude of 7.2 kilometers (4.5 miles). If this observation were taken alone, some doubt might be thrown upon its accuracy. But, while no other station secured an observation to that altitude, there was, at other stations in that region, a rapid gain in wind speed with increase in height up to the maximum altitude attained. Hence, there is good reason for believing that high winds prevailed in the free air on that date. An examination of the sea-level pressure shows that the region between the Mississippi River and the Appalachians was dominated by high pressure, and, so far as surface winds are concerned, such a pressure distribution is usually associated with winds of no great intensity.

An inspection of the horizontal temperature difference between points in the northern and southern parts of the United States reveals an unusually steep gradient, and this, from our earlier considerations, points toward the likelihood of high, free-air winds. Fig. 1 shows this distribution of pressure and temperature. The solid lines are isobars at sea-level and the dotted lines, surface isotherms. Fig. 2 shows the isobars at 2-kilometers above sea-level, not as observed, but as computed from surface conditions. The difference between the sealevel isobaric distribution and that at 2 kilometers is at once striking, but when the closeness of the parallel isobars in the free air is considered together with the fact that free-air winds wherever they were observed by kites or pilot balloons agreed in direction with the trend of the isobars, the significance and importance of such maps for aviation becomes apparent. There was very little, on that date, in the daily weather map to guide the forecaster in his estimate of free-air winds. Maps of the free-air pressure distribution would certainly have assisted him.

This brief exposition of the theory, the tests, and some of the practical phases of the making of pressure maps for upper levels, is simply the record of recent research on the subject. It has not yet been given actual day-to-day trial in the Weather Bureau, although such trials are contemplated. It can be said without extravagence, however, that these charts introduce into the weather map that other dimension which distinguishes the world of the aviator from that of the pedestrian, and, as a consequence, they anticipate the day when our knowledge of conditions in the free-air will be released from the shackles of surmise.

A New Caproni Giant

The firm of Caproni has begun construction of a new giant "noviplane" along the lines of the transatlantic machine that was wrecked on its preliminary trials two years ago. The new design does not depart radically from the first attempt at that type, but will be of stronger and more rugged construction throughout.

As will be remembered, this ship was a "triple tandem triplane" with a long cabin of the general shape of a railway car, and carried no tail, the ailerons on the rear set of wings taking the place of the elevator while lateral direction was obtained by vertical rudders placed between the wing panels.

In the present design the body is 74 ft. long, of V-shaped bottom and with a small step amidships and one about two-thirds way back. The bottom is divided into 10 watertight compartments. Seats for 100 passengers are arranged along a central corridor running the length of the cabin. The pilots are at the bow, and the ship can be steered either from within the enclosed cabin or from an exposed "bridge."

The power plant consists of 8 Liberty motors, giving a total of 3200 hp. The motors are arranged in two groups, one on the front set and one on the rear set of planes, of four motors each, three being tractors and one pusher. An engineer is in charge of each motor group who receives his orders by telephone and signal apparatus from the pilot.

To facilitate leaving the water, vanes are placed between the body and wing floats. The latter are located under the first or inner set of struts.

The dimensions and characteristics of this machine are as follows:

Span, 98 ft.
Length, 74 ft.
Height, 31 ft.
Gap, 18 ft.
Carrying surface (about) 7500 sq. ft.
Hp. (8 Liberty 400), 3200
Weight empty, 27,200 lb.
Useful load, 22,00
Total, 49,200
Fuel load sufficient for 6 hr. flight.
Dimensions

Warning to Aviators

Ohio—Maumee River—High tension cable—A high-tension electric cable carrying 66,000 volts crosses the Maumee River parallel with and on the northern side of the Lower Terminal Bridge. The line consists of two wires, one above the other and 30 ft. apart, the minimum height above the water being 107 ft. and the maximum height 137 ft. These wires are supported on two towers, one on each bank of the river, each 216 ft. high above the water. The tower on the east bank is located 73 ft. and the one on the west bank 80 ft. from the harbor line.

U. S. Lake Survey Chart 374.

(N.A. 11, 1922.)

The Army Air Service

By Maj. Gen. Mason M. Patrick

Chief of Air Service, U. S. Army

(Concluded from last issue)

Flying Cadets

Flying cadets are a class of personnel in the Air Service who come mainly from two sources—the ranks and civil life. Upon becoming flying cadets they are placed immediately under flying instruction and graduation from the prescribed courses qualifies them for a commission in the Organized Reserve. Only 190 flying cadets are at present authorized, and these must come out of the allotment of 8,500 personnel for the Air Service.

Graduate flying cadets are practically the only source of flying personnel for the National Guard and the Organized Reserve. When it is considered that the six field armies and general headquarters reserve heretofore mentioned need somewhat over ten thousand flying officers, only a handful of whom are in the regular army, there is at once seen the great necessity for training as large a number of flying cadets as possible. It is estimated that 2,500 flying cadets must be trained each year to keep an active force of approximately 10,000 flying officers in the National Guard and Organized Reserve. Casualties, temperamental unfitness, waning enthusiasm, business or family reasons, and physical defects force a large percentage of reserve pilots each year to retire from the available list, thereby causing this large estimated replacement. Think of the number of training centers that would have to be established and the consequent size of the Air Service in peace to carry out this one function of the regular Air Service in order to comply with the intent of the amended National Defense Act.

Our flying schools are open to the flying cadet at all times and the maximum number should be in attendance. An opportunity is here presented for the physically fit and intellectually qualified civilian between the ages of 20 and 27 to secure the best flying training in the world at government expense, and in addition to be paid a salary and be supplied with quarters, clothes, food, medical attention, as well as all the other numerous benefits that go with military service.

A commission in the Air Service Reserve is awarded to all graduate flying cadets.

The present reduced strength Air Service further comprises:

(d)—Garrisons for Panama, Hawaiian Islands, and Philippine Islands.

(e)—A small number of service squadrons (air parks), distributed where most needed for the upkeep of flying equipment. The group of four fighting squadrons is the principal tactical unit of the Air Service. As a part of each group there is a service squadron (formerly designated as "air park") that performs the supply functions for the group and does such repair work on the equipment as cannot be accomplished in the squadrons or is not assigned to the repair depots. The attack, bombardment and pursuit groups are organized in this way and also the school groups which conduct the Primary and Advanced Flying Schools. Mitchel, Bolling, and Langley Fields each have a service squadron to care for and repair equipment for those units there that are not in a group organization.

(f)—One airship company for Ordnance Department experimental work at Aberdeen Proving Ground. The principal use of this airship company is to drop bombs for testing all the component parts of the bomb. There is also at Aberdeen a bombardment squadron detached from the Bombardment Group and engaged upon similar work.

There are many duties in addition to those enumerated in the brief outline above, that the Air Service performs for other branches of the army or departments of the Government. Among these is the forest fire patrol—a great accomplishment in itself. In a few hours an area can now be covered by air which heretofore has taken many days and great effort on the part of watchmen or lookouts. Patrols are now carried on by the Air Service over some of the forests on the Pacific Coast. If the size and duties of the Air Service would permit more patrol work would be done in other parts of the country. Hundreds of thousands of miles have been flown in forest fire patrol and hundreds of fires located and reported, thus saving millions of dollars in timber and untold hardships of fighting fires that would not otherwise have been discovered until much later.

Some Interesting Experiments

Interesting experiments have been carried on in spraying trees and plants from the air in an effort to prevent the ravages in insects, in Ohio thus fighting caterpillars; in New Hampshire, the gypsy moth, in Louisiana, the boll weevil. This work has been done in cooperation with the Department of Agriculture. Treatment of large areas of trees or growing crops in this manner saves much time and labor.

Constant cooperation is had with the Bureau of Standards. The numerous experiments and tests made by the Bureau of Standards in cooperation with the Air Service have established a very close relation between the two agencies, and have solved many of the difficult problems that have been presented in mastering the air.

Many mapping projects have been undertaken for the various departments and bureaus of the government. Among the mosaics made and furnished by the Air Service are Camp Benning (200 sq. mi.), Walter Reed Hospital, Fort Myer, City of Boston, District of Columbia, Bibb County, Ga.; Los Angeles County, Calif.; San Diego County, Calif.; La Jolla County, Calif., Reelfoot Lake, Tenn.; 150 square miles in vicinity of Amherst, Mass.; Susquehanna River, Coast Lines at Portland, Me.; and all Air Service stations. In addition, thousands of square miles of territory have been surveyed and mapped from the air, and a great number of special photographs have been taken. Every department of the government and many bureaus, municipalities and individuals have been supplied with aerial photographs and maps to assist them in their work. The importance of aerial photography and surveying has not been underestimated by those who have seen its accomplishments and the time is not distant when a much greater use will be made of this form of mapping, especially when speed is a factor and the area to be mapped is extensive.

Air Service Supply System

Not the least among the functions of the Air Service, is the operation of its own great supply system. The problem of supplying to the many different types of Air Service units the thousands of different articles that are required is one that calls for the greatest coordination and painstaking effort.

It is estimated that no less than 225,000 different parts must be kept on hand to supply the requirements of five different kinds of airplanes (attack, bombardment, observation, pursuit and training), and two different kinds of lighter-than-air equipment (balloons and airships). Hundreds of these parts vary so slightly in appearance that, when separated from the major assembly, only an expert can identify them. Standardization is attempted wherever possible, but due to the rapid change in design of equipment, this is many times quite impracticable. Cataloging the parts of all standard types of equipment has been undertaken in an effort to assist the operating personnel of the Air Service to make proper inventories and requisitions. In addition to all these different parts there is a vast quantity of tools that must be kept on hand.

The distribution and issue of equipment, spare parts and tools is a problem that is difficult of solution with the limited transportation funds that are available. To cover this function, supply and repair depots are distributed geographically to care for Air Service organizations in all parts of the

country. These depots carry stocks of material designed in assortment and quantity to meet the needs of the organizations within their respective areas. Supply and repair depots are now established at the following places

San Antonio, Tex. (Kelly Field)
Fairfield, Ohio (Wilbur Wright Field)
San Diego, Calif (Rockwell Field)
Belleville, Ill. (Scott Field)
Middletown, Penn
Little Rock, Ark.

It is contemplated making some changes in the location of depots so as to affect greater economy and efficiency. Many depots have been closed since the armistice and the large amounts of surplus property contained in them have been either sold, issued, or stored as a war reserve. The repair feature of these depots is worthy of special mention. Large amounts of equipment have been overhauled and reconditioned, many crashed planes have been rebuilt, a great quantity of salvage work has been done. This action has saved large sums of money and has set a standard of maintenance that is the pride of our service

The Engineering Division

Design, experimental construction, test and development of airplanes, balloons, airships, aircraft motors, armament, equipment and accessories necessary to meet the requirements of the Air Service and the preparation of drawings, specifications, etc. as may be necessary for the procurement of this material, are carried on by the Engineering Division at McCook Field, Dayton, Ohio, and the neighboring station at Fairfield, Ohio.

There is no work more important to the Air Service than that of the Engineering Division. Their stamp of approval on flying equipment means to the flier that it has been thoroughly tested, both in the shops and laboratories, and in the air, and as a result has been found safe for use. This division acts as a check upon the manufacturers, inspecting all material used and seeing that construction is carried out in accordance with contracts. The large appropriations made annually for expenditure by this division are a direct measure of their responsibilities and of the confidence placed in their work.

Although the Engineering Division is primarily interested in military equipment, a great deal of information and practice is brought out in development work that is valuable to commercial aviation. The fundamental principles of design and construction are the same in both military and commercial aircraft, and a large number of finished articles such as engines, photographs and wireless equipment, instruments and other accessories developed and used through military necessity have an immediate application in the operation of commercial aircraft. Aviation information collected by the Engineering Division from all sources in this country and foreign countries is carefully studied, investigated and digested and then distributed, to help as far as practicable, in the general progress of aeronautics

Collecting Aeronautical Information

On account of the rapid development, not only in aeronautical equipment but in the use of aircraft, it has been found necessary to establish a division in the Office of the Chief of Air Service for the purpose of collecting information covering the whole field of aeronautical development throughout the world. Gathering information from foreign sources is accomplished through the Military Intelligence Division of the General Staff. Air Service assistants have been detailed to the Office of the Military Attachés in London, Paris, Berlin, Rome and Tokyo

Much valuable material is also found in the reports to the State Department and the Commerce Department

The Information Division coordinates in activities with the National Advisory Committee for Aeronautics and the Bureau of Aeronautics, Navy. Information received from these sources is compiled and disseminated to all governmental agencies interested in aeronautics, since a large part of the aeronautical experience of the United States is centered in the Army Air Service. All information and reports that would be of value in developing commercial aeronautics are given wide dissemination through special reports to commercial concerns and through aeronautical journals, magazines, and newspapers.

The Air Service library, with branch libraries at all Air Service activities, is conducted by the Information Division. The collection in this library, consisting of books, magazines and special reports, is one of the most complete in the world and the material contained therein is widely used by governmental agencies and civilian concerns. This Division maintains a file of all photographs, mosaics and moving pictures taken from aircraft and is charged with the duty of their dissemination for official use. The Historical files of the Office, Bureau of Aircraft Production, Office, Director of Military Intelligence and of the Air Service in the American Expeditionary Forces are part of the library.

Present organization has developed from the Information Section of the Office, Director of Military Aeronautics, which was one of the first organizations established in that office at the outbreak of the war. Its work steadily increased in volume and importance.

Preparedness for War Emergency

The question of how the Air Service is to be prepared as regards equipment at the outbreak of a war is at present difficult to answer. It is the policy of all first-class powers to build up war reserves of equipment so as to reduce the burden upon declaration of war and "get the jump" on the enemy. This can be done with battleships, arms, ammunition, motor vehicles, etc., but not with the "stick and fabric" airplane or the more perishable balloon and airship envelopes. It, therefore, appears that a large airplane manufacturing industry capable of going into war time production on short notice is the best war reserve, and every effort is being made to stimulate the growth of this industry

The building up of a war reserve of personnel is also a problem that cannot be satisfactorily cared for until either commercial aeronautics increases to much greater proportions in this country, or Congress appropriates funds to adequately care for the training of the reserve. As heretofore stated, there are approximately ten thousand pilots required for the National Guard and Organized Reserve, and practically the only sources of this personnel are the Air Service schools, the aerial mail and the existing commercial enterprises. Everything possible is being done to increase the efficiency and strength of the reserve, but the problem is quite unlike that found in any other branch of the service and requires large expenditures of money and a constant flow of high class personnel into the training machine.

Every effort is being made to induce Congress to increase the appropriations provided for the pay and allowances of reserve officers on active duty in attendance at Special Service Schools, and in future it is hoped that a number much larger than could be secured this year may be trained at these Schools.

Training camps for Air Service Reserve officers were held during the past Summer in each corps area. Their success was very gratifying and if future camps can be made available to a greater number of Reserve officers, the morale and efficiency of the Air Service Reserve Corps will be greatly increased

The Air Service is represented by six Reserve Officers Training Corps Units in the following colleges and universities

Massachusetts Institute of Technology, Cambridge, Mass.
Georgia School of Technology, Atlanta, Ga.
University of Illinois, Urbana, Ill
Texas Agricultural & Mechanical College, College Station, Tex
University of California, Berkeley, Calif
University of Washington, Seattle, Wash.

The regular engineering courses, pursued by practically all of those enrolled, fit naturally into the special Air Service training pursued during the four academic years. Each student is required to attend a basic and an advanced camp, the latter being devoted to practical and theoretical "ground subjects," together with several hours of observation training in the air. When funds become available it is planned to call all graduates to active duty for six months when they will be

given flying instruction and thus become thoroughly trained Reserve officers.

Air Service Stations

The stations of the Air Service are those built up during the World War and contain very little permanent construction. A program of construction has been formulated and it is hoped that the next Congress will appropriate funds for building barracks and quarters at some of our stations. It will be many years, however, before the Air Service stations have permanent construction throughout.

A few of the war time stations have been dismantled and sold, while others are held on an inactive status for the storage of material and use by the National Guard and Organized Reserve. Among this latter class are

Park Field, Millington, Tenn
Carlstrom and Dorr Fields, Arcadia, Fla
Ellington Field, Houston, Tex.
Rockwell Field, San Diego, Calif.
Ross Field, Arcadia, Calif.
March Field, Riverside, Calif.
Mather Field, Sacramento, Calif

Airway Development

It is possible that many of the Air Service stations both active and inactive may become key stations in our system of national airways. The President has shown his interest in airway development in his first message to Congress and it is believed Congress will assist more and more by appropriations so that this most important work may be carried on

The Air Service has already made tremendous strides in this direction. Some 2,500 landing fields have been listed and information regarding them is being checked and tabulated in form for ready use. A model airway has been established connecting Langley, Bolling, Mitchel, and McCook Fields, Bolling Field being the key station. Radio and meteorological stations have been erected and data regarding the weather is always available. Departure and arrival of planes is reported by radio. Regular trips are made carrying passengers and baggage. Special maps are being prepared with only that data essential and desirable to the pilots. Fields have been marked. Great quantities of data are being collected with a view to assisting development of aerial enterprises.

One of the most important of our projects is the establishment of reserve airdromes in our large cities where our Reserve officers and National Guard units may be given an opportunity for air work. Four of these airdromes, namely at Boston, Mass.; Pittsburgh, Penn., Kansas City, Mo., and Los Angeles, Calif., are now being constructed. The entire project includes twenty-one cities and it is hoped that funds will become available for the completion of the program within the near future

At these airdromes approved commercial aviation will be encouraged and each should ultimately become an important station in our Airway System and the center of the community's aeronautical development

The problems of the Air Service are many and varied and there are very few precedents to follow. The Infantry, Cavalry, and Artillery have years of experience behind them; they have traditions and history that tend to stabilize their present organization and development, they are well established and their duties clearly defined. On the other hand, the Air Service is still an infant branch of the Army; its organization is but little beyond the embryonic state; its traditions are few, its history is short. The possibilities before the Air Service seem unlimited, leaving its scope of action not altogether defined. Development continues at a rapid rate, organization is not yet stabilized and is continually undergoing changes, new types of equipment are constantly being produced. Efforts have been made to establish certain policies but changes are rapid. All these conditions make the burden heavy on the small Air Service we have, but at the same time interest is never lagging and new fields of work are always at hand to be explored.

The Air Service has a wonderful future before it. The time will come when we shall see the military activities in the air at least coordinate with those on the land and on the water. The bombing maneuvers of last year off Hampton Roads clearly and undisputably indicated through the sinking of the capital ship that the Air Service if supported by Congressional appropriation, has a mighty capacity for national defense of our long coast lines against naval attack.

Great developments are still to take place. The air must be further explored for additional meteorological data to increase the safety of flight. The airplane that can successfully combat most conditions of weather must be developed. Great airways must be established with adequate landing fields, service stations, airway markers, etc. The physical fitness of pilots must be assured. A system of federal license and inspection must be put in force to insure the safety of travel by air and to protect those who choose to remain on earthly lanes. The possibilities of the helicopter must be developed and applied to the military airplane. A cheaper and more extensive supply of helium must be found. Forest fire patrol should be extended. Further and more adequate means of waging war on the enemies of plant life should be developed. The use of the airplane more generally for surveying, photographing and exploration, is to be encouraged. The development of aerial torpedoes and radio controlled aircraft must be carried to the point where they may become effective in war. The development of mufflers, heating apparatus, starters, goggles, and other devices for the comfort and convenience of pilot and passenger should receive attention. The production of all-metal planes, with a minimum of parts and simplicity of construction and assembly, must come. Means of making a getaway and landing in small areas should be developed. Rules and regulations for aerial traffic must be drawn up. And so on with a hundred more items. Truly the field of exploration, discovery, invention, and work in the air seems unlimited.

The Air Service will not be without its problems for many years to come—problems without precedents and in a comparatively unexplored field. They demand for their solution time, energy, and money. May Congress see fit by liberal appropriations to encourage this new and powerful aid to military and commercial enterprises, which is destined to revolutionize many of our present forms of endeavor and play such an important part in the lives of future generations.

Encouraging Original Design

An outline of the services rendered the French aircraft industry by the Section Technique (the French counterpart of our Air Service Engineering Division) is contained in a report by Vice Consul John F. Simmons, Paris, in a recent issue of Commerce Reports (U. S. Dept. of Commerce). He states that the Service Technique outlines the type of craft desired, and any manufacturer may submit a design, according to the conditions specified. If the manufacturer's type is selected, the firm receives a trial order, and if the craft is successful the firm receives an additional order with the assurance that no other manufacturer will produce its type of craft without paying the firm a royalty. Thus each manufacturer is induced to produce original designs, as he knows that quantity orders will be given to his firm and not to a rival, who, not having had to bear the cost of experimenting, might be able to underbid him.

The Service Technique passes on all models, the tests being made at one of the best equipped laboratories in the world, located at Issy-les-Moulineaux. These laboratories are all new and the largest wind tunnel which has yet been constructed will soon be put into operation at Issy.

District Chairmen, N.A.A.

In the table showing the officers and governors of the National Aeronautic Association of U.S.A. printed in the Nov. 30 issue of Aviation, Bernard H. Mulvihill was erroneously named as permanent chairman of the Third District. According to the by-laws of the N.A.A. two governors are elected from each of the nine districts, one of whom is the permanent chairman of the respective district. As the table shows elsewhere, the two governors from the third district are Lewis F. Sevier and R. J. Walters, and Mr. Sevier is chairman of this district.

The Grand Prize of Paris

Farman F90 Wins French Air Transport Competition

The French air transport competition for the 100,000 francs Grand Prize of Paris, which was held in the middle of November at Le Bourget airport, was won by Lucien Bossoutrot on a Farman F90 5-passenger cabin biplane equipped with a 300 hp Salmson engine Thus a single engined ship won this difficult competition, the rules of which particularly favored multi-engined aircraft.

The Conditions

The conditions of the Grand Prize of Paris were briefly as follows The competition was open to French airplanes carrying two pilot's seats in the control cockpit, and five passenger seats at least in the cabin. The passenger seats had to be at least 17 in wide, face forward, and enable a man 6 ft tall to sit comfortably without hunching. The presence of a crew of two was obligatory on board during all trials. The commercial load was calculated as 100 kg per passenger, of which 20 kg were to represent the baggage This load could be represented by sand bags of the weight equivalent to each passenger, in which case, each bag was to be attached on the respective seat, while separate sand bags representing the baggage were to be loaded into a special baggage compartment.

The competition consisted of preliminary trials covering general features thought to be desirable in commercial airplanes, and of flying trials which were to bring out safety features. For all trials points were awarded, as shown below

The preliminary trials were divided as follows: (A) horsepower expenditure per passenger carried, 150, 50 and 25 points in order of precedence; (B) Use of radio telephone during flight up to a distance of at least 10 kilometers, 25 points; (C) Stopping and starting one engine of the power plant in flight, 25 points; (D) Starting the power plant on the ground, the entire crew being on board, 25 points.

The Flying Trials

The flying trials consisted of a safety test, a starting and landing test, and a speed test In the safety test (E) the contestant had to fly for 1½ hr. carrying full pay load and 1 hr. fuel *with one engine stopped* and make the following performances: (a) take off, (b) climb to a height not exceeding 500 meters and remain there 10 min describing one right handed and one left handed circle, (c) climb after completion of test (b) another 500 meters in 30 min The take off and climb to 500 meters counted for 100 points; the horizontal flight for 50 points, and the second climb for 100 points. The starting and landing tests (F) were determined by the length of the ground run, 75, 50 and 25 points being given for first, second and third place. The speed test (G) was to be run on two consecutive days over a 100 kilometer circuit, as follows on the first day a distance of 300 kilometers was twice to be covered with full load and one obligatory stop made en route, when the power plant had to be stopped, on the second day 600 kilometers had to be covered with one half the specified load Both tests had to be accomplished without any intermediate landing save that specified for the 300 kilometer flights, any forced landing causing the contestant to be disqualified. An average speed of less than 100 kilometers per hour also disqualified the contestant In these speed tests 3 points were given for every kilometer above the minimum speed up to a total of 300 points, and in addition 100, 50 and 25 points were awarded for first, second and third place

The Competition

The great severity of these conditions, which was much criticized by the French aeronautical press as was the criterion which determined the award of points, was undoubtedly responsible for the small number of entries received The principal characteristics of the entries are given in the accompanying table. The Mureaux machine is a Vickers "Commercial" built under license in France. The Breguet "Leviathan" is a tractor biplane equipped with a central engine room in which four Breguet-Bugatti engines are housed. The power plant drives the single propeller through a connector-disconnector device (which was described in detail in AVIATION) whereby a failing power unit is automatically thrown out of clutch if the engine revolutions drop below a certain number The power plant of the Leviathan has been undergoing trials for almost two years, and it was recently reported that it bed during one trial turned for 2 hr with a total power output of 900 hp.

Although the Leviathan failed to finish in the competition owing to accessory trouble, the fact that the machine successfully passed the majority of the severe tests is a valuable indication of the possibilities of the central engine room arrangement. As a matter of fact the elimination of this interesting ship is said to have come about in an odd way While flying the speed test, a spark plug broke, whereupon the mechanic disconnected the engine to fit a new plug But in his hurry to do so he accidentally leaned against the clutch lever and so disconnected a second engine As the pilot was flying at a height of only 150 ft. owing to poor visibility, the loss of 50 per cent of the horsepower caused him to land which automatically eliminated him from the competition

The Caudron C74, piloted by Poirée, was a four-engined cabin biplane with two sets of tandem propellers. This ship is a development of the C61 three-engined passenger plane exhibited at the last Paris aero show. The Farman F90, piloted by Bossoutrot, represents a refinement of the F70 type which was produced early in 1921 as a combination design to be used as either a four passenger cabin ship or as a corps observation-combat machine. The Potez X is a three-engined cabin biplane, and was exhibited at the last Paris aero show, in connection with which it was described in the Dec. 19, 1921, issue of AVIATION. This ship failed to arrive in time for the preliminary trials, and therefore did not take part in the competition.

Extremely bad weather reigned all during the trials, with low visibility, rain and fogs, so that the speed tests had twice to be postponed. The following number of points was awarded in the preliminary trials and in all the flying trials except the speed tests·

Characteristics of the French Transport Airplanes Entered for the Grand Prize of Paris

Make	Engines	Total hp	Useful ld kg	Gross wt. kg	Wing area sq m.	Max spd. km.h.	Span m.	Length m.	Height m.
Mureaux	2—370 hp. Lorraine	740	2274	8670	123 8	185	20 72	18 80	4 62
Leviathan	4—228 hp Bugatti	950	2100	6800	140 5	170	26 84	14 06	8 14
Caudron 74	4—300 hp. Hispano	1230	2150	6000	130 0	200*	25 00	16 60	4.87
Farman 90	1—300 hp. Salmson	300	1100	2200	62 0		14.00	8 20	3 85
Potez X	3—180 hp. Hispano	540	1420	3720	85 0	170	18 50	12 38	4.15

* Estimated.

TABLE SHOWING POINTS AWARDED IN THE COMPETITION

Machine	Pilot	Trials A	B	C	D	E	F	Total
Leviathan	Thiery	25	25	25	25	250	50	400
Farman F90	Bossoutrot	150	—	25	25	—	75	275
Caudron C74	Poiree	—	(*)	25	25	150	—	200
Mureaux	Labouchere	50	25	25	25	—	25	150

NOTE—A dash in a column means that the trial in question was not attempted As asterisk (*) indicates that the trial was unsuccessfully attempted

It does not appear clearly from the regulations of the competition whether failure to comply with all the trials specified eliminated a contestant Judging from the above table, however, and also from the fact that the victorious Farman F90 was a single-engined machine and hence could not carry out test (E)—that is, climb with one engine stopped—it must be assumed the award of the prize rested with the officials of the Aero Club of France.

Owing to the bad weather the first speed trial was postponed to Nov 14, and it was decided, in order to facilitate the task of the pilots in the low visibility to reduce the length of the course to 40 kilometers Consequently the course had to be covered each day sixteen times

Bossoutrot on the Farman F90 covered the 600 kilometers of the first speed test in 4 hr 7 min elapsed time, and in 3 hr 45 min flying time, which makes an average speed of 160 km p h or about 100 m.p h The Leviathan was eliminated that day as above stated, and Labouchere, on the Mureaux "Express" was forced down by water circulation leakage The Caudron C74, piloted by the veteran Poiree, crashed on the fifth lap and killed its pilot and two mechanics when the left hand rear propeller broke or flew off its hub and literally cut the fuselage in two, thus depriving the machine of its controls.

This left only the Farman F90 to complete the speed tests, which it did the following day by covering the 600 kilometers in 4 hr 11 min elapsed time, which works out as an average speed of 143 3 km p h (88 8 m.p h) The 300 hp Salmson model AZ9 engine is a commercial version of the war time Z9 model with which many French commercial airplanes are equipped

Glider Development

The development of a motorless airplane capable of reaching an altitude of 20,000 ft is the aim of Dr George H Madelung, designer of the Hannover glider, who is employed as project engineer at the Glenn L. Martin Co.

Dr Madelung believes a glider can ascend to a height of 20,000 ft and support not only its own weight, but also that of a cable reaching to a moving object, such as a battleship or destroyer

Under these conditions the glider would function as a kite, with the difference that it would be controlled. Such a glider would replace kite and observation balloons, and it would have the additional advantage of being less visible to an enemy and less dangerous for its crew in case of attack.

When he wished to descend the pilot would simply drop the cable and glide to a landing place either on the ship or near by

The report of the London *Daily Chronicle's* observer that German scientists plan construction of huge gliders, capable of carrying large weights for hundreds of miles, is described as "bunk" by Dr Madelung

"Given the same area, or wing surface, a glider must be from five to ten times lighter than a motor driven plane," he said. "And as the size is increased, the wing loading must be increased to overcome the dead weight of the structure. If the lifting area is doubled, the dead weight is more than doubled. The larger the plane, the nearer you approach a point where the plane will not support a useful load"

However, flights of hundreds of miles in a glider are possible, Dr Madelung believes. A motorless plane could be carried aloft by warm currents, glide on its way to another spot where the currents rise upward, go through the same performance to gain altitude and so on until darkness or until its destination had been reached.

This, of course, would require a charting of the air currents so pilots would know where to glide to gain altitude. Gliding at night is impossible in the opinion of Dr. Madelung as the air currents are then descending. Incidentally, soaring birds never fly at night.

Italian Type O. S. Airship

This new airship was built lately by the Stabilimento di Costruzioni Aeronautiche at Rome, Italy Her general features do not differ materially from those of the semi-rigid type to which Italian aeronautics owns every success achieved up to now in the field of airship construction. Her aerodynamic characteristics, however, are a great improvement on those of the past, owing to some important improvements effected in the design of the stern and to better static stability.

Above the Italian semirigid airship OS1 in flight. Below. Close-up view of the car

The envelope is 223 ft long and has a capacity of 169 551 cu. ft. It is made of single-ply fabric with rubber on both sides. The ballonets are separated by means of lacquered silk partitions

The tail surfaces are rigidly braced by steel tube struts. These are arranged over the fabric of the envelope and are joined through two hoops which have the same section streamlining the airship in question The keel girder extends along the lower curvature of the hull from stem to stern. It is built of steel tubes which are joined in such a manner as to render the system practically elastic.

The wooden car is completely closed and accommodates beside a crew of four, six passengers. For the convenience of the latter comfortable chairs are provided. Windows, which can be opened, are fitted the full length of both sides of the cabin, giving a very fine view.

Two 120 hp Colombo Combi engines are mounted on outriggers at the rear end of the car, and drive two walnut propellers of the pusher type.

On her first trial trip the O. S. airship reached a speed of 53 m.p.h. While the O. S. is still an experimental type, its trials have been very promising, indicating that with the increased lift and endurance this ship is a decided improvement on other types of airship having the same capacity.

An Aerial Picnic in France

By W. Wallace Kellett

A most interesting illustration of the peaceful pleasures of flying was afforded by the recent aero-picnic given by the Aero Club of France for its members. Tiring of the conventional flying meetings—which are held every week in France in four or five different towns—the directors of the Aero Club decided to give the enthusiastic flyers, and they are numerous, something different.

Further to interest the public in aviation, and to encourage aerial touring, they organized a picnic to which everyone should come by air. They first termed the picnic "the 104 of the 104th" meaning that 104 invited members of the Club would meet at the 104th kilometer of the Paris-Granville road, at which point lies the charming village of Tillières. As it happened however, there were 120 aero-picnickers, and the Secretary plans to choose the 200th kilometer to accomodate the guests at the next picnic.

As early as nine o'clock in the morning the guests began to arrive. From then until noon the small pasture adjacent to the country inn at Tillières presented a lively scene as the planes gracefully landed with their cargoes of picnickers. In small machines and large ones they arrived—there were sport planes carrying one or two people, and giant passenger planes carrying a dozen—in all thirty five machines of almost every type built in France. Last but not least to arrive was M. Laurent Eynac, under-secretary of state for aeronautics, who was warmly greeted by the picnickers, already united into a happy family.

The good looking girls, silk robes, bare arms, charming smiles, faces flushed with the thrill of the air would go far to whet the appetite of any picnicker, and every single one had flown to Tillières. At mid-day came the dinner, served at small tables underneath the shady trees of the "Bois Joli". It was, an old fashioned picnic dinner, delicious, from "aperitifs to liquers". Then came the concert—to which each guest who could sing, or dance or tell a funny story, contributed his or her part. The afternoon passed all too quickly for everyone.

With the coming of dusk, the great mechanical birds, resting since noon, were put in action again and the "104 of the 104th"

The aerial picknickers listen to Normand folk songs at the conclusion of a cheerful luncheon. The French air minister is seated at the left of the reciting lady

took the air to return to their various nests by the light of the setting sun.

Is there not something in events of this kind, taking place with increasing frequency in countries certainly no more progressive than ours, worthy of consideration? How better can aviation, so useful commercially and agreeable as a sport in times of peace, so indispensible in time of war, be brought closer to the heart of the wide-awake patriotic citizen?

German Aeronautic Emigration

For some time past German aeronautic enterprises have been emigrating to foreign lands, or have been trying to do so, with a view to circumventing the restrictions of the treaty of Versailles in the matter of German aircraft construction.

The attempts of the Zeppelin and Schuette-Lanz companies to gain a foothold in the United States and Spain are well known, and it appears from recent intelligence that the Spanish Zeppelin company has already broken ground for the erection of a huge airship hangar at Seville.

German heavier-than-air interests have similarly been active in establishing foreign branch organizations which would not be hampered by Allied building restrictions, while the mother enterprise would limit its activities to establishing the plans of new "unauthorized" aircraft and aeronautic engines. After Anthony Fokker, who returned to his native Holland after building aircraft for Germany during the war, the Dornier company established branches in Switzerland and in Italy, where it took over the large Gallinari aircraft plant, at Pisa. The Junkers firm has at various times been reported to be contemplating to establish an aircraft factory in Russia. An experimental Maybach engine of great power was recently built and tested in Holland, while several minor German firms have built new types of aircraft in Sweden.

The latest accession to the ranks of Germany's aeronautic emigrates is Herr Rohrbach, late chief engineer of the Zeppelin-Staaken airplane works where he built a four-engined all-metal monoplane. He has just established an aircraft construction firm at Copenhagen, Denmark. This firm, called the Rofawerke, will have as Danish manager Erik Hildesheim, who contributed numerous articles on German aircraft to Aviation, and Herr Rohrbach will be the chief engineer.

As Others See Us

From *The Aeroplane* (London) —

"All concerned with American aviation deserve to be congratulated heartily on the astounding results achieved by American airplanes in the Politzer Trophy Race and in Mr Maughan's speed record attempts thereafter. There was a time when we in Europe were justifiably sceptical about the figures published for American records, whether for speed, altitude, duration, or distance, but in these days when the United States Air Services are themselves intimately concerned with all such records it may be taken that figures are invariably and indisputably accurate. In fact they are probably more accurate than those of any other country in that for altitude and speed performances the most highly developed types of measuring instruments are used.

"Mr Maughan's wonderful speed performances more than justified the principle on which the United States Air Services (Military and Naval) encourage the American Aircraft Industry. The record-breaking single-seater of today is if not actually the single-seater fighter of tomorrow at any rate the type from which the fighter is best developed. It is therefore very well worth the while of the services in any country to act on the same principle and order the building of pure speed machines."

British Imperial Air Mail Survey

The civil aviation advisory board of the British air ministry in July 1922 submitted to parliament a complete survey on imperial air mail services and their possibilities. It is proposed to have several services linking up an air line to India, by means of privately operated companies sufficiently subsidized to insure a small percentage on capital invested.

New Splitdorf Magneto for Aircraft Engines

Ignition System Specially Developed for Aircraft

The Splitdorf Electrical Co. has added to its line a new series of magnetos known as Models S and SS. This company has long been known by its successful development of the inductor type of magneto. The development of the new series has been underway for several years and is the direct result of attempting to improve the design of the inductor type magneto so as to increase the efficiency. To obtain a greater electrical output has been the aim in the development of this new series. The new magneto is at present made in two sizes, the smaller one known as Model S and the larger one known as Model SS. The ignition mentioned in previous articles in Aviation describing the winning planes in the Pulitzer and Curtiss Marine Trophy Races were the models SS12 and SS9 respectively.

The Splitdorf Model S Magneto is being manufactured in 1, 2, 3, 4, and 6 cylinder types. It is of a very neat design and light in weight.

Constructional Details

The Model SS magneto is similar in construction to the smaller size and is particularly adaptable to larger engines or where a spark of greater volume is required. Model SS is especially adaptable to aircraft ignition. It is manufactured for engines of from one to twelve cylinders, inclusive.

The following figures taken from the characteristic curves of these magnetos prepared by the Engineering Department of the Splitdorf Electrical Co. give an idea of the capabilities of the magnetos.

New Splitdorf magneto model SS

The model S in advance position produces sparks regularly over a 0.020 in. spark gap under 60 lb. compression at 40 r.p.m. and under 100 lb. compression at 90 r.p.m. Model SS under the same conditions sparks under 70 lb. compression at 30 r.p.m. and under 100 lb. compression at 50 r.p.m.

In this new Splitdorf series the model S has a single permanent magnet, while in the model SS two magnets are used. The magnet or magnets are arranged with the planes transverse to the rotor axis. The effective cross-section of the magnets is the same from end to end.

The design of the rotor is particularly interesting. A through steel shaft supported on ball bearings is used. The rotating laminations are effectively fastened to the shaft by reason of being anchored in non-magnetic material which is cast under pressure around the shaft and laminations. There are several advantages of this construction. A solid shaft naturally makes a more rigid construction than one built up of several parts. The shaft is not magnetized and some magnetic leakage is therefore eliminated. The total magnetic reluctance of the air gaps has been reduced by increasing the areas.

The frame of the magneto is an aluminum die casting. In this casting are anchored two magnet pole pieces and two coil pole pieces. The casting is made of an alloy especially developed to take care of the difference in shrinkage and temperature. The surfaces on which rest the permanent magnets and the coil core are ground, as are also the ends of the magnets and of the coil core. This insures excellent joints at these points, which further increases the efficiency of the magneto.

The coil core is attached to the frame by means of clamps and the area of the joints at these points is considerably larger than in previous designs. More space has been allowed for the coil, which permits even greater insulation so that the possibility of electrical breakdown is at a minimum. Primary

Splitdorf model SS magneto with the front cover removed

wires are soldered to the coil terminals, this being done to insure good contact.

The breaker mechanism follows in general Splitdorf practise in which the breaker bar and stationary contact point are carried on a plate which is movable for advance and retard. The breaker bar is operated by means of a cam on the rotor shaft. By having the contact points fixed it is possible to examine them while the magneto is in operation. The bearing of the breaker bar shaft is not required to take current, a pig-tail connection, one end of which is fastened to the breaker bar and the other to the magneto frame conducts the current from the movable contact point to ground. The breaker is so constructed as to suit the high operating speeds common with aircraft motors.

The Mica condenser, which is of standard Splitdorf pattern, is mounted on the breaker base and is carried in a metallic housing. On the face of the condenser is a card illustrating the method of adjusting the contact points. On model SS the condenser is attached to the frame of the magneto in the distributor compartment.

The advance lever is mounted in the front cover and by means of a short shaft and crank engages a slot in the breaker base, thereby allowing the base to be moved for advance and retard positions.

Accessibility

The distributor is mounted above and in the same compartment with the breaker. This compartment is closed by means of the front cover, which when removed provides an excellent means of examining the breaker and distributor mechanisms. The distributor disc is attached to the distributor shaft and in the model S magneto is provided with one segment which contacts with the brushes in the distributor block. In the model SS Aircraft Magnetos the distributor disc has a non-corrosive brush which registers with segments in the distributor block.

The insulating materials used in the New Splitdorf Series are Americanite and Bakelite, the first being an insulating compound of high dielectric and mechanical strength produced by the Splitdorf Company.

The cover is formed from a single piece of non-magnetic sheet metal, dapped at its edges to insure waterproofing. The cover is held in place by clamps recessed into the frame. These clamps are held by screws which are wired and sealed at the Splitdorf factory.

It will be of interest to note that the manufacture of the essential units of the Splitdorf magnetos are absolutely within the control of the Splitdorf Co. in that it insulates its own wire—winds its own coils—makes its own magnets—molds its own insulating material, etc.

Manufacturers Oppose Hull Bill

James A Emery, counsel for Manufacturers' Committee speaking on Nov 29 before the subcommittee on Naval Affairs in opposition to the Hull bill (H R 10967), which provides for exclusive manufacture by the Government of military and naval supplies including aircraft and aircraft engines and puts the arsenals and navy yards in the manufacture of supplies in competition with private constructors, urged

That the bill is fundamentally objectionable because, on the broadest scale, it puts the Government into the business of general manufacture in competition with its own citizens and under conditions of unfair competition That it is an impracticable proposal which could operate upon the scale suggested only at great expense to the Government and involves a continuing fraud upon the public in the form of an arbitrarily determined cost of production which eliminates actual elements of cost and leaves the determination of these to the discretion of an irresponsible official. That it is in continuing contradiction with the plans of military defense established under existing law out of long experience and under the direction and advice of highly trained and experienced military specialists That the history of the origin and progressive development of military defense illustrates the continual reliance upon private invention and experiment for the progress of weapons and ammunition and the capacity to produce them upon the scale necessary to national defense That it is intended and will operate to employ a large and unnecessary force in Government establishments at continually increasing expense to the taxpayer, without any corresponding gain to the people of the United States. That, under all these conditions, it would discourage and destroy the cooperation between the military departments of the Government and private establishments essential to the national defense and, under a pretense of economy, work a serious injury to the maintenance and development of private industry of the utmost benefit to the American people. That the bill establishes offices and bureaus in the Army and Navy departments operating independently of their executive heads and possessed of a subversive discretion, the very purpose and effect of the exercise of which is to destroy administrative direction and discipline and force the Government into socialistic experiments in manufacture for which its establishments were neither conceived nor can be equipped without enormous expense or loss That the whole measure is in conflict with the terms and operating theory of the plan of national defense outlined in the acts of legislation of 1916 and 1920, and was not submitted to and is not approved by the responsible departments and officers charged with preparation for national defense

Mr Emery represented the National Association of Manufacturers, the National Metal Trades Association, the National Founders' Association and State Associations of Manufacturers, and was accompanied by a large group of representative manufacturers and in many lines of business Mr Emery said in part

A Revolutionary Proposal

"The Hull Bill is a revolutionary proposal, originating in the Metal Trades Department of the American Federation of Labor It is intended not only to prevent any lessening of the number of employees in the navy yards and arsenals but to multiply their number This is to be accomplished by requiring the Government to manufacture exclusively every requirement of the Army and Navy, from warships to clothing In addition, the arsenals and navy yards, by direction of their department heads, or at the request of any other department or bureau, are directed to submit competent bids for every form of Government supply in competition with private producers

"There is an apparent limitation upon this direction which is verbal but not real The public plants are directed to manufacture only what they are "equipped" to produce But the test of this fact is not industrial but historical If they have ever done "similar" work, they are conclusively presumed to be "fully equipped to do the work." The Government establishments in estimating their cost of production are directed not to include any overhead or other expense due to maintaining the facilities and equipment of such establishments for military purposes. They are thus peremptorily required to exclude the essential actual items of their own cost of production in order to secure an apparent cheapness which may delude the taxpayer into the belief that Government production had in accordance with their direction is cheaper than private production To insure the obtainment of the work by Government establishments, an independent bureau is to be established in the War and Navy Departments, the head of which must be in sympathy with the purpose of this measure and whose duty, not subject to the direction of the head of the War or Navy Departments, is to "review, revise and control the estimates for work for the department with a view to have such work performed in the department's own industrial establishment," and he is further directed to solicit work from every department of the Government An arbitrary and uncontrolled discretion is thus imposed in a bureau officer for the purpose of securing a revision of Government bids upon an artificial basis of cost in order to insure the manufacture of Government supplies by Government establishments.

"A revolving fund is further provided for each establishment composed of moneys receivable in accordance with their estimates of cost but not expended in the performance of any work No department is to be charged in excess of the estimated cost where it is actually exceeded, but such deficits are to be paid out of such fund."

Progress of the Sampaio Correia II

The H16 flying boat Sampaio Correia II, pilot Walter Hinton, left Paramaribo, Dutch Guiana, on Nov 26 for Cayenne, French Guiana, where she arrived the same day, having covered the distance of 210 miles in 3 hr 59 min She remained at Cayenne until Dec 1, the time spent being used in patching up the wings which had suffered from contact with the jungle growth on the Sinnamarie river in the mouth of which she had landed on account of engine trouble A burned out generator, which had caused this trouble was also replaced

It may be noted in passing that Cayenne is the seat of a French air transport company, the Transports Aériens Guyanais, which maintains regular seaplane services between that city and Saint-Laurent-du-Maroni and Inini, in the interior

On Dec 1 the Sampaio Correia II left Cayenne en route for Amapa, on the Brazilian mainland opposite Maraca Island, a distance of 245 miles which she covered in 4 hr. 38 min On the following day the boat continued her journey by flying from Amapa to Para (which the Brazilians call Belem to distinguish it from the name of the state of Para), where she reached after a flight of 3 hr 1 min, the distance covered being 270 miles The crew was given a rousing reception by the governor and the population

Sky Writing over New York

Last week New York was treated for the first time to the spectacle of sky writing, an art which is meeting with growing favor in Europe for advertising purposes. The demonstration was made by Capt Cyril Turner, formerly of the Royal Air Force, who used an SE5 single seater fighter for the purpose

Flying at about 10,000 ft above Park Place, Captain Turner liberated a trail of white smoke and spelled "Hello" across the sky Above Longacre Square he traced "Hello U S A" in the heavens The letters were perfectly formed, and hung in the air for many minutes. Each letter was about a mile in height.

The chemical vapor used in the stunt passed through a tube at the extreme rear of the plane and hung like a white streamer in the sky, the pilot controlling it with levers, and forming the letters by maneuvering his plane Nearly 8,000,000 cu ft. of vapor were used to form each letter, and the apparatus produced the vapor at a rate of 250,000 cu ft. every second

Large crowds witnessed the performance which was particularly successful on account of a very clear day

ARMY AND NAVY AIR NEWS

Air Service

Target Practice by Anti-Aircraft Troops—Anti-aircraft troops established an enviable record for efficiency in recent firings at Fort Monroe, Va., when the troops of the 61st Artillery Battalion (Anti-Aircraft) placed five shots within destructive range, out of twenty-two fired, at a target towed by a seaplane from the Hampton Roads Naval Air Station. This was the first time in the history of the American Army that firings have been conducted on a target towed by an airplane. The results accomplished mark a new era in the development of the American system of anti-aircraft defense, for it has been demonstrated that a target can be towed by an airplane for anti-aircraft target practice without danger to the pilot.

Due to the co-operation of Captain Yarnell, U.S.N., Commanding Officer at the Air Station, a target and tow line were improvised and within forty-eight hours after the request was made for the co-operation, a seaplane piloted by Lieut. W. K. Patterson, U.S.N., towed the target which was fired upon. The target was in the shape of a sleeve, three feet in diameter and fourteen feet long. It was towed through the air at a speed of 60 to 80 m.p.h. by a cable 2500 ft. long, which was fastened to Lieutenant Patterson's plane. Eight courses were flown from Rip Raps to Back River light, at altitudes varying from 5000 to 7000 ft. The sky was overcast and the target, which at times was obscured by clouds, appeared scarcely as large as a lady's stocking.

The anti-aircraft troops opened fire with both 3-in. guns and machine guns. The average range for the firing was 3,000 yd. While this is greater than the effective range of the machine guns, which were placed on special anti-aircraft mounts, excellent marksmanship was displayed as indicated by the use of tracer bullets which showed the line of fire to be through the target at practically all times.

That there is no danger for the pilot of the plane towing an aerial target, provided the gunners are well trained, is shown by the fact that although the tow line was 2500 ft. long, the shot which came closest to the plane during the entire flight was 2200 ft. behind the aviator. As the seaplane used is much heavier than the average land plane which would be used for towing, and not so easily maneuvered, it is believed that any objection which aviators may have to towing targets for anti-aircraft firing has been overcome as the result of these tests.

* * *

Distinguished Service Cross Citation—The Distinguished Service Cross has been awarded Lieut. Jesse O. Creech, A.S., with the following citation:

"For extraordinary heroism in action. Being on enemy patrol on Sept. 26, 1918, when a large number of enemy airplanes were encountered, in the fight that ensued Lieutenant Creech shot down two of the enemy planes and saved the commander of our patrol from being shot down. On Oct. 28, 1918, Lieutenant Creech's flight of five planes was attacked by eight Fokker biplanes. In this encounter Lieutenant Creech also shot down two enemy planes. On Sept. 28, Lieutenant Creech with his flight attacked an enemy balloon and compelled the observers to jump. Enemy troops were then attacked in close formation causing many casualties and scattering all the troops. In all these encounters Lieutenant Creech displayed high courage, great valor and utter disregard of danger. He constantly went to the assistance of members of his flight and exposed himself with great fearlessness and yet with all displayed keen judgment and tireless energy. He proved himself a leader of unusual ability and was a constant inspiration to the members of his command."

Crissy Field—During the review and ceremony at the unveiling of the Pershing statue, Armistice Day, planes from Crissy Field flew over the Golden Gate Park. The first unit was in charge of Capt. A. F Herold of the R.O.T.C The planes were piloted by Lieutenants Summerfield, Pugh, Stewart and McDonald After the unveiling these officers flew to San Jose and took part in the parade there. Following the reserve officers came planes piloted by Lieuts. E C Kiel, W. A. Maxwell, W C Goldsborough, J W Benton, L F Post and Sergts. F. Steinle, T. Powers, C B Guile, D Templeton and Fred Kelly of the regular Air Service.

Crissy Field is the only Air Service station in the 9th Corps Area at which training activities will be conducted to an appreciable extent during the winter period. A training schedule, submitted to the Commanding Officer by Capt. J. W Signer, has been approved and is now being carried into effect. A course consisting of theoretical and practical military instruction has been established for officers and noncommissioned officers, and appropriate courses for the balance of the enlisted personnel These courses will be followed by special theoretical and practical instruction which pertains to the Observation Squadron Photo Section No 15 is also conducting classes in its special line of work.

Maj Arthur R Christie, who until recently was on duty as Assistant Military Attaché at Tokyo, Japan, was a recent visitor at Crissy Field

Naval Aviation

Design of Airship ZR1 Approved—All elements of design and construction of the Navy's fleet airship No. 1, better known as the ZR1, have been approved by a special committee of engineers and experts appointed by the National Advisory Committee for Aeronautics at the request of the Naval Bureau of Aeronautics Work of assembly, now well under way, will be completed by July 1, 1923, it is estimated by the naval constructors.

It is agreed by the committee members that all available airship information has been applied in the ZR1 designs and that the naval engineers have used good judgment throughout. The basing of the fundamental design on the successful German Zeppelin L49 has also found favor in the eyes of the investigators, who not only checked the plans and specifications but have tested the materials used and 200 full-sized girders for strength Carefully outlined and detailed tests of the 680 ft airship upon her completion, as provided by the naval engineers, have also been endorsed by the N.A.C.A. as a safety precaution

Dr Henry Goldmark, a well-known consulting engineer of New York, heads the special committee, which includes the following engineering and aeronautical experts Prof. William Hovgaard of Boston, director of warship design at Massachusetts Institute of Technology, and internationally recognized as the foremost authority on the structural strength

Coming Aeronautical Events

FOREIGN

1923

Dec. 15-Jan. 2 — *8th International Aeronautic Exposition, Paris, France*

June — *International Aero Congress, London.*

of ships; Dr. L. B Tuckerman, physicist of the Bureau of Standards, Dr Max M. Munk, aeronautical expert of the National Advisory Committee for Aeronautics, and Prof W. Watters Pagon of the Civil Engineering Department of Johns Hopkins University, Baltimore, Md. For practically five months since its first meeting in June, which was called to order by Rear Admiral D. W. Taylor, U.S.N., the committee has been studying and checking the plans of the airship holding in all fifteen full meetings

Briefly the specifications for the naval airship call for a rigid craft built of duralumin trusses and girders, containing twenty separate gas bags totaling 2,155,200 cu ft., and covered with a single envelope Her total length is 680 ft and her diameter is 78 ft Six separate cars are suspended from her keel, each carrying a 300 hp. Packard aircraft engine.

* * *

Aircraft Carriers and National Defense—That the air fleet of an enemy will never get within striking distance of our coasts as long as our aircraft carriers are able to carry the preponderance of air power to sea is the opinion Rear Admiral William A Moffett, Chief of the Bureau of Aeronautics, expressed on his return, recently, from an inspection of the new airplane carrier Langley which is carrying on experiments in Chesapeake Bay

"I have seen planes successfully land on, and take off from, the Langley," said Admiral Moffett, "and a thorough test was made of the features of the ship which will enable our airplane carriers to afford the maximum of service in aircraft defense and offense to the Navy. We are working along correct lines in the development of the carrier All developments that are incorporated in the Langley have been evolved by American talent and represent the most advanced thought and careful investigation on the subject."

Admiral Moffett urged that the full tonnage of airplane carriers allowed this country under the Limitation of Armament Treaty be built. "We are allowed a tonnage of 135,000 tons in carriers for aircraft under the Limitation of Armament Treaty," added Admiral Moffett, "and we will need every ton of this to supply an adequate aviation complement to the Fleet. Other countries have agreed that this figure expresses the minimum of our requirements and surely we cannot afford to rate ourselves lower than the rating which we have been assigned by international agreement."

The Langley, which is the first airplane carrier to be built by this country, has been operating in Chesapeake Bay and off the Virginia Capes since September, but until recently no aviation operations were attempted owing to the preliminary work of organization on the new ship The first landing was made on her deck by Lieut. Comdr Godfrey Chevalier, U.S.N The Langley is commanded by Capt S. H. R. Doyle, U.S.N., who was formerly commanding officer of the Naval Air Station at Hampton Roads.

* * *

Officers Selected for Aviation Training—The following named naval officers have been selected for aviation training in the class commencing at Pensacola naval air station Jan 1, 1923

Ens. Edgar L Adams, Ens. Chas Carter Anderson, Ens Russell D. Bell, Ens. Horton Ivey Brooker, Ens K. E Brimmer, Lieut. Junius L. Cotten, Lieut Arthur B Craig, Ens George Merrich Dusmberre, Ens Robt P. Erdman, Lieut Rollin V A Fatling, Ens Roy E Farnsworth, Lieut. George R Fairlamb, Ens. Ralph W. Floody, Ens Oliver W. Gaines, Ens. Hilyer F Gearing, Ens. Richard P. Glass, Ens Marvin H Grove, Lieut. Chas Graham Halpine, Lieut C. L. Hayden, Lieut Osborne B Hardison, Ens. Justin Downing Hartford, Ens Richard Highleyman, Ens. C M. Huntington, Ens Chas. L. Hatton, Lieut. Conrad A. Kraz, Lieut Stuart A Maher, Ens. Ellsworth D Eathron, Ens G A Patterson, Ens John Perry, Lieut. Douglas A Powell, Ens. Frederick W. Roberts, Lieut Charles Harry Rochey, Lieut Harry A Rochester, Lieut. H S Sease, Ens. Walton Wiley Smith, Ens Morton B Sterling, Lieut. Lyman K Swenson, Ens. Barnett Thomas Talbott, Ens. Jackson R. Tate, Ens. R D. Threshie, Ens. C L. Tyler, Ens. B P Ward, Ens. C. R Woodson, Ens. John F Wegforth

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